

## SIX NEW DRAGONFLY LARVAE OF THE FAMILY GOMPHIDAE IN COSTA RICA, WITH A KEY TO THE CENTRAL AMERICAN GENERA (ANISOPTERA)

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Based on material reared in the laboratory, for the first time descriptions and illustrations are presented of the larvae of *Phyllogomphoides bifasciatus*, *Epigomphus subsimilis*, *E. subobtusus*, *E. echeverrii*, *Erpetogomphus constrictor* and *E. tristani*. *Erpetogomphus sabaleticus* is redescribed. Comments on biology, taxonomic relationships and a key to the Central American genera are provided.

### INTRODUCTION

The family Gomphidae in Costa Rica is composed of ten genera (PAULSON, 1982; C. Esquivel, pers. comm.) and 35 species, viz. *Agriogomphus* Sel. (1 sp.), *Aphylla* Sel. (3 spp.), *Archaeogomphus* Wllmsn (1 sp.), *Desmogomphus* Wllmsn (1 sp.), *Epigomphus* Sel. (11 spp.), *Erpetogomphus* Sel. (4 spp.), *Perigomphus* Belle (1 sp.), *Phyllocycla* Calv. (2 spp.), *Phyllogomphoides* Belle (5 spp.) and *Progomphus* Sel. (6 spp.).

The taxonomic knowledge of the larval stage of the family in Costa Rica is summarized as follows:

The larval stage of the 59% of the species are undescribed. All the monospecific genera have their larvae described: *Archaeogomphus furcatus* (BELLE, 1992), *Agriogomphus tumens* (NOVELO, 1989), *Desmogomphus paucinervis* and *Perigomphus pallidistylus* (WESTFALL, 1989).

*Aphylla* and *Phyllocycla* each have all but one of their larvae described. Of six *Progomphus* species reported for the country, four are certainly known and two are putative (BELLE, 1991).

Of the *Erpetogomphus* species, those described here are the first ones to Costa Rica. The *Epigomphus* species described here are the first descriptions for Costa

Rica. NEEDHAM (1901) described, by supposition, the larval stage of the genus, but the description is short and without details; MARTINS (1968) described the only *Epigomphus* larva hitherto known: *E. paludosus*. In *Phyllogomphoides* of Costa Rica the only larva described is that of *P. suasus* (NOVELO, 1992).

#### MATERIAL AND METHODS

All larvae were collected at Maritza Biological Station, Guanacaste National Park; El Rodeo Protected Zone, San José province; Miravalles, Guanacaste province; and Sanguijuela creek, Braulio Carrillo National Park.

#### *PHYLLOGOMPHOIDES BIFASCIATUS* (HAGEN IN SELYS, 1878)

Figures 1-10

**Material.** – [1 larva, last instar (♂, reared), 2 exuviae (♂, reared)]. – COSTA RICA: Guanacaste, Miravalles, near the geothermal project, 26-IV-1993, C. Esquivel leg., in author's collection.

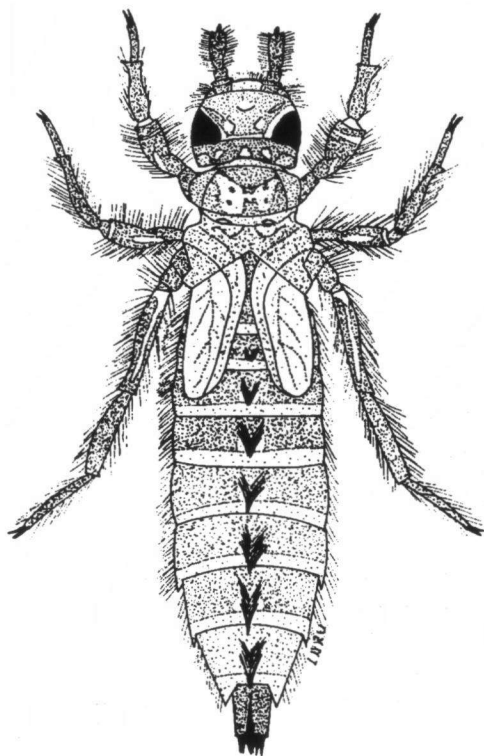


Fig. 1. *Phyllogomphoides bifasciatus*, last instar larva, dorsal view.

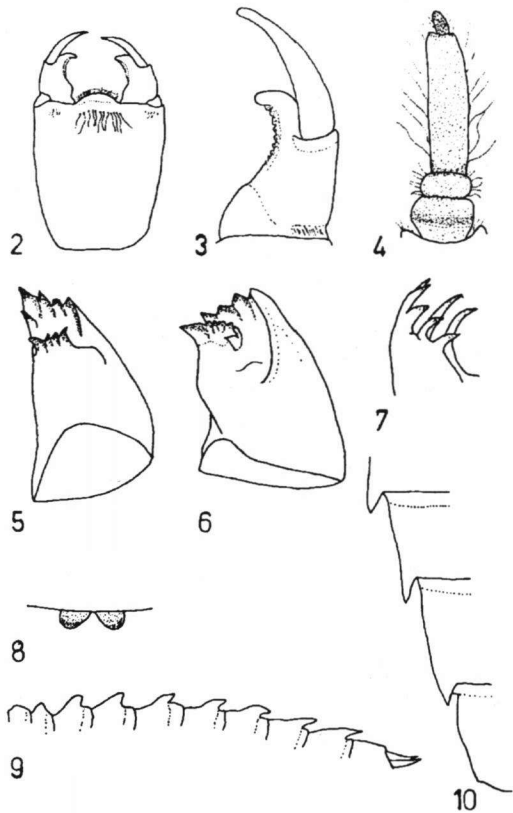
**DESCRIPTION.** – Brown or brownish, body granulated and with many widespread setae (Fig. 1).

**Head.** – Wider than long, with three whitish ocelli. Antennae 4-jointed (Fig. 4), the third the largest and longer than wide, slightly flat; the fourth the smallest; proportion of the antennomeres: 0.36, 0.20, 1.0, 0.30. All the antennomeres covered with long thin setae. Posterior margin of the head slightly concave. Frons and vertex with scale-like setae, bare areas are: a triangular central area with a circular one to each side of it, cephalic lobes with rows of scale-like setae. Labium light brown, articulation of the postmentum and prementum reaching the anterior margin of the mesocoxae. Prementum bare (Fig. 2), with parallel sides, but distal part slightly wider; with a row of setae at the base of the ligula, in ventral view. Ligula convex, with a row of robust, medium truncated

scale-like setae, all of the same size. Palpus with a single end-hook strongly curved inward and with the internal margin serrated, with eight short strong teeth; external lateral margin with some long and light setae (Fig. 3). Labrum, in ventral view, with a row of long setae on its anterior margin, another row of spiniform setae medially. Mandibles biramous (Figs 5-6), external branch of the right mandible with four cuspids, the ventral one with a little cuspid at its base; internal branch with four cuspids, the externals twice the size of the internals. The left mandible has four cuspids in the external branch, the internal with a large dorsal cuspid and five short ones arranged in a semicircular manner. Maxillae with seven long incurved hooks on the laciniae (Fig. 7); galeae with long setae all around it.

**T h o r a x.** — Pronotum slightly square with the two spiracles at the posterior margin. Wing cases divergent, reaching the middle of abdominal segment four. Legs strongly pubescent, and granulosus. Profemur and mesofemur cylindrical and thicker than the tibiae. Hind legs flattened laterally. Tarsal formula 2-2-3.

**A b d o m e n.** — Enlarged, with many long setae at its lateral margins; posterior margins of segments 6-9, in dorsal view, with a row of little spiniform setae; segments 7-9 with lateral spines (Fig. 10), largest on 9; those on 7 outcurved, and those on 9 parallel to the margin of segment 10. Tergites 2-9 with dorsal hooks, gradually increasing in size rearward (Fig. 9); those on 7-9 slightly overlapping the next segment; segment 10 as long as 9. Gonapophyses evident in the female (Fig. 8). Caudal appendages same size, 0.5 of segment 10; apical part acutely-pointed and light in



Figs 2-10. Details of the morphology of *Phyllogomphoides bifasciatus*: (2) prementum, dorsal view; — (3) labial palpus, dorsal view; — (4) antenna, dorsal view; — (5-6) left and right mandibles, resp., ventrolateral view; — (7) lacinia, ventral view; — (8) female gonapophyses, ventral view; — (9) abdominal dorsal hooks, lateral view; — (10) abdominal lateral spines segments 7-10, ventral view.

color.

**Measurements** (in mm). – Total length 33.7; abdomen 22.3; abdomen maximum width 6.6; width of the head over the eyes 6.1; hind femur 5.3; prementum, width 4.5, length 5.3.

**BIOLOGY.** – The larvae live in a creek that runs through secondary forest. The water flow was strong, the channel being 1.5 m wide 0.2–0.6 m deep. The larvae were living in zones of reduced flow and muddy bottoms; the creek shores were covered with grasses and secondary vegetation. This kind of habitat is similar to that mentioned in previous papers (e.g. NOVELO, 1992). The transformation of the larva occurs when it climbs a stone or a plant near the shore.

The larvae are large, but their color and shape are so cryptic that they are difficult to find.

**DISCUSSION.** – This genus comprises 42 species (GARRISON, 1991), all neotropical. The date only 11 larvae are known (NOVELO, 1992). Of the five species reported for Costa Rica (PAULSON, 1982), only *P. suasus*, is described (NOVELO, 1992). With the addition of *P. bifasciatus* three larvae remain undescribed.

The Costa Rican species are readily separated:

- Internal branch of the right mandible with four cuspids, the externals larger than the ones in the middle. Abdominal dorsal hooks truncated (Fig. 9). Lateral spines on 8 outcurved (Fig. 10)..... *bifasciatus*
- Internal branch of the right mandible with 5–7 cuspids, all of the same size. Abdominal dorsal hook acutely-pointed. Lateral spines on 8 incurved ..... *suasus*

The species described here were collected in the Pacific slopes. It is not known whether *P. suasus* is sympatric with *P. bifasciatus*.

BELLE (1970, 1982) split the genus into three groups, which were used by NOVELO (1992) to define the existence of two main lineages, one South American, the other Middle American, each characterized by larval morphology. The species here described is part of the Middle American lineage.

### *EPIGOMPHUS SUBSIMILIS* (CALVERT, 1920)

Figures 11–17, 20

**Material.** – [3 larvae, last instar (♂, reared), 2 exuviae (♂, ♀, reared). – COSTA RICA: San José, Ciudad Colón, Zona Protectora El Rodeo, 11-II-1991, 12-VIII-1990, 14-IV-1991, A. Ramírez leg., in author's collection.

**DESCRIPTION.** – Larvae and exuviae brown or brownish, body dorsoventrally flattened (Fig. 11).

**Head.** – Granulated, with many short setae, a fringe of long setae between antennal base and the compound eye; wider than long, with three whitish ocelli. Antennae granulated, 4-jointed (Fig. 16), the third the largest, flattened and wide, with many long setae on the lateral margins and a row of dark points close to the border; the fourth the smallest; proportion of the antennomeres: 0.3, 0.2, 1.0, 0.05. Posterior margin of the head slightly concave. Frons and vertex with scale-like

setae, bare as follows: a triangular central area with a circular one to each side of it, cephalic lobes with vertical rows of scale-like setae. Labium glabrous, articulation of the postmentum and prementum reaching the procoxae. Prementum bare, slightly longer than wide (Fig. 12). Ligula, in ventral view, with a row of robust, medium truncated teeth (Fig. 15), and a row of long setae two times as long as the teeth (Fig. 14). Palpi (Fig. 13) with a row of short dark teeth along the internal margin, external margin with a fringe of short setae. Movable hook 1.5 times the

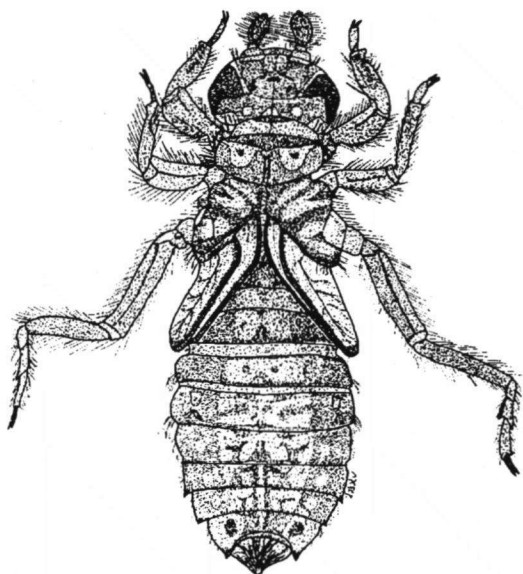
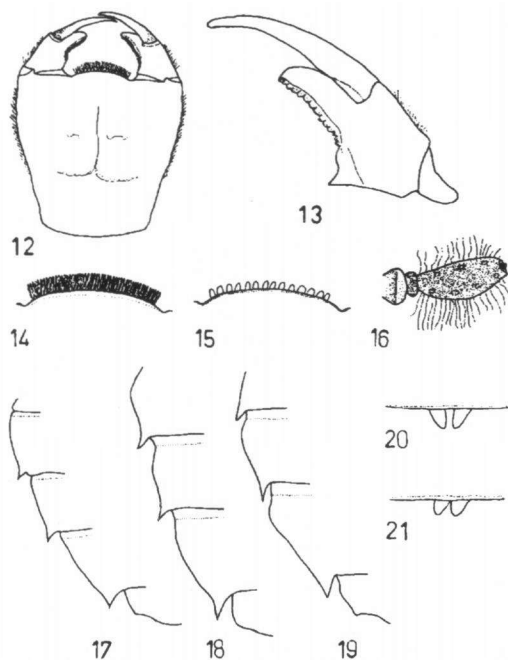


Fig. 11. *Epigomphus subsimilis*, last instar larva, dorsal view.

length of the palpi. Labrum with many setae of the frontal margin, in ventral view with a row of long setae at each side of the internal margin. Mandibles biramous, external branch with four cuspids, the ventral one with a little cuspid at its base; internal branch with two large external cuspids, and four small ones in the middle. Maxillae with seven long incurved hooks on the laciniae; galeae with long setae all around it.

**Thorax.** — Granulous, with many long setae along the lateral margins. Pronotum with the two spiracles at the posterior margin. Synthorax slightly wider than prothorax. Wing cases strongly divergent, reaching posterior margin of abdominal segment 3, granulated and with few setae. Legs cylindric, strongly pubescent. Protibiae with a row of long setae. The claws have fine setae in the apical 0.3. Tarsal formula 2-2-3.

**Abdomen.** — Dorsally brownish in the middle, a little darker toward lateral margins, segments 9-10 reddish, with a point on each segment at each side of the mid line. Slightly less granulated, in dorsal view, than the rest of the body, with some long setae widespread on its dorsal face. Dorsal hooks absent. Segments 7-9 with lateral spines, largest on 9 and divergent (Fig. 17). Lateral margins with the following setal distribution: 1-6 long, along the entire margin, 7-10 with fringes in the basal 0.40. Segments 7-9 with serrated lateral margins; abdominal segment 10 short. Relation of the last segments, 7-10: 0.85-0.75-1.0-0.25. Gonapophyses evident in the female (Fig. 20). Caudal appendages same size, reddish, as long as segments 9-10 together; with long setae on the internal margins.



Figs 12-16. Details of the morphology of *Epigomphus subsimilis*: (12) prementum, dorsal view; – (13) labial palpus, dorsal view; – (14) ligula setae distribution, ventral view; – (15) ligula tooth distribution, dorsal view; – (16) antenna, dorsal view. – Figs 17-21. Details of the morphology of *Epigomphus* spp. (17-19) abdominal lateral spines of *E. subsimilis* (17), *E. echeverrii* (18) and *E. subobtusus* (19); – (20) *E. subsimilis*, gonapophyses, ventral view; – (21) *E. subobtusus* gonapophyses, ventral view.

–black and less granulated than *E. subsimilis*. Lateral spines divergent (Fig. 18) Setae on lateral margins 1-6 more dense at the apical 0.30.

**Measurements** (in mm). – Total length 27.5; abdomen 18.5; abdomen maximum width 8.3; hind femur 6.0; prementum, width 3.9, length 4.9.

### *EPIGOMPHUS SUBOBTUSUS* CALVERT, 1900

Figures 19, 21

**Material**. – [2 exuviae, last instar (♀, reared)]. – COSTA RICA: San José, Parque Nacional Braulio Carrillo, Quebrada Sanguijuela. 20-III-1992, A. Ramírez leg., in author's collection.

**DESCRIPTION**. – Exuviae dark brown, body heavily granulated. Similar to *E. subsimilis*, with the following differences:

**Measurements** (in mm). – Total length 25.0; abdomen 14.5; abdomen maximum width 8.0; hind femur 4.5; prementum, width 3.6, length 4.9.

### *EPIGOMPHUS ECHEVERRII* BROOKS, 1987

Figure 18

**Material**. – [2 exuviae, last instar (♂, reared)]. – COSTA RICA: Guanacaste, Parque Nacional Guanacaste, Estación Maritza. 25-VII-1991, A. Ramírez leg., in author's collection.

**DESCRIPTION**. – Exuviae dark brown. Similar to *E. subsimilis*, with the following differences:

**Head**. – External branch of the left mandible without the basal cuspid at the base of the ventral one. Ventral side of the prementum with short setae. Palpi with long setae on the lateral external margins.

**Thorax**. – Wing cases with many setae on the margins and few elsewhere.

**Abdomen**. – Brownish, segments 8-10 reddish-brown. Caudal appendages reddish-

**H e a d.** – External branch of the left mandible like *E. echeverrii*, inner branch with two large external cuspids and three short internal cuspids. Palpi like *E. echeverrii*.

**T h o r a x.** – Wing cases with few setae at the lateral margins, denser in the apical part.

**A b d o m e n.** – Granulated without setae on the dorsal surface, reddish-brown, segments 8-10 darkest. Lateral spines parallel (Fig. 19). Setae on abdominal segments 1-6 grouped in an apical fringe, with few setae elsewhere; 8-9 with few setae in the basal part and 10 without any. Lateral margins less serrated than in the other species. Gonapophyses evident (Fig. 21).

**M e a s u r e m e n t s** (in mm). – Total length 25.7; abdomen 16.0; abdomen maximum width 7.2; hind femur 5.0; prementum, width 3.6, length 4.9.

**BIOLOGY.** – *Epigomphus* larvae are found at the bottom of creeks, not deeper than 3 cm below the substrate. *E. subsimilis* were collected on the Pacific slope, in creeks of secondary forest, classified as Dry Tropical Forest (HOLDRIDGE et al., 1971), with pronounced wet and dry seasons. Most creeks were less than 1 m wide and about 0.4 m deep. The bottom was mostly composed of gravel and organic matter. Larvae are found in different substrates (gravel, sand, organic matter). It was interesting to note a larva that normally walks slowly, with their fore and middle legs, was able to swim fast with the help of anal propulsion.

The transformation lasted about an hour and twenty minutes. No preference for a special time of the day was observed, but often happened during the morning.

Larvae of *E. echeverrii* were collected in a seasonal creek similar to the one described for *E. subsimilis*, but in this case the creek runs through primary forest with less variation in the water level (C. de la Rosa, pers. comm.). The creek has a stony substrate with scattered patches of organic matter. The larvae were found in the gravel where the flow was slow and the creek was not so deep. No larva was in its last instar; those collected molted three times in the laboratory before emergence, which happened a year after collection. This suggests that this species spends a long time in the water.

Larvae of *E. subobtusus* were sampled in the Caribbean slope, in a primary forest creek, at 750 m.a.s.l. In this area the forest is less seasonal, with little annual change in the water level. The creek is 1-2 m wide and 0.1-1.0 m deep, few pools deeper than 3 m. The bottom is composed of gravel and sand, some places have a great amount of organic matter. Larvae of *E. subobtusus* were found in few places with fine organic matter and mud. They are very cryptic and hard to find in these substrates. They stay immobile when out of the water, a behavior that contrasts with that shown by other species of the genus.

**E m e r g e n c e.** – Emergence of all three *Epigomphus* species takes place only if the substrate is solid and firm. Under these conditions the adult will be able to place their legs on the exuviae and on the substrate at the same time. It occurs in three steps:

- (a) Location of a substrate on which to emerge: the larvae swim faster than usual until they find a suitable place.
- (b) Transformation: the larvae leave the water, climb to the substrate and start the transformation, in horizontal position. The teneral starts the transformation using the exuviae as their only substrate. This step finishes when the teneral has the abdomen as long as the wings.
- (c) Location of a different substrate and end of the transformation: at this stage the teneral looks for another substrate, using its three legs of one side. The teneral never leaves the exuviae, the transformation is completed with one side on the exuviae and the other three legs on the new substrate. After a while the new adult flies to perch.

Laboratory observations suggest that passing from the step (b) to (c) is critical in the process. In the laboratory, steps (a) and (b) occurred in a muddy substrate, but for completion of the transformation a solid substrate must be available. If it is not, the teneral falls into the water or mud.

These critical moments were observed in the laboratory, but in nature, a population would be able to find many different substrates to use in the process.

DISCUSSION. – The genus includes 26 species (GARRISON, 1991), with 11 in Costa Rica. MARTINS (1968) described the sole hitherto known larva; unfortunately the description is too brief to enable a comparison.

The larvae of the three species treated here are very similar, but they can be separated as follows:

- |    |  |                   |
|----|--|-------------------|
| 1  | Abdominal lateral spines divergent (Figs 17-18) .....  | 2                 |
| 1' | Abdominal lateral spines parallel (Fig. 19) .....  | <i>subobtusus</i> |
| 2  | Wing cases with many long setae on their lateral margins, external lateral margins of the labial palpi with long setae ..... | <i>echeverrii</i> |
| 2' | Wing cases with few setae, external lateral margins of the labial palpi with short setae .....                               | <i>subsimilis</i> |

### *ERPETO GOMPHUS CONSTRICTOR* RIS, 1918

Figures 22-25, 28-29, 33

**Material.** – [3 larvae, last instar (♂, reared), 2 exuviae (♂, ♀, reared)]. – COSTA RICA: San José, Ciudad Colón, Zona Protectora El Rodeo, 11-II-1991, 12-VIII-1990, 14-IV-1991, A. Ramírez leg., in author's collection.

**DESCRIPTION.** – Larvae and exuviae brown or brownish, body flattened dorso-ventrally, with many scamiform-like setae (Fig. 22).

**Head.** – Wider than long, with three whitish ocelli. Antennae granulated, 4-jointed (Fig. 25), the first and the second about the same size, the third is the longest, five times as long as the second; the fourth is the smallest; all the antennomeres covered by short setae. Posterior margin of the head concave. Frons and vertex with scale-like setae. Labium glabrous, articulation of postmentum and



prementum reaching procoxae. Prementum bare (Fig. 23), ligula convex with its margin serrated in ventral view, and with a row of fine setae. Palpus without end hook and with the inner margin serrated (Fig. 24). Labrum with many setae at the frontal margin in dorsal view, in ventral view with two rows of setae, with a row of long setae in front. Mandibles biramous, the right with four cuspids on the external branch, the ventral is the largest and has a little one at its base; the internal branch with a large dorsal tooth of the same height as the external branch, and other little ones next to this. Left mandible with four teeth, the ventral is the largest, the internal one with six cuspids arranged in a semicircular manner. Maxillae with seven long incurved hooks in the laciniae; galea with long setae all around it.

**T h o r a x.** — Wing cases strongly divergent, reaching the middle part of abdominal segment 4. Legs strongly pubescent, with long and fine setae.

**A b d o m e n.** — Dorsally brownish. Dorsal hooks present on all segments except 10 (Fig. 33), increasing in size toward the distal part. Segments 5-9 with lateral spines, increasing in size to the distal part (Figs 28-29). Lateral margins of 5-9 with row of little spines, more evident in 6-9. Segment 10 with a row of very small spines, less evident than in the other segments. The dorsal posterior margins of all the segments except 10, have a row of spines that cover the entire margin, even the dorsal hooks. Epiproct with a row of small spines on the dorsal margin. The paraprocts are glabrous ventrally, and dorsally have some setae on their external lateral margins. Cercus glabrous except for a row of tiny spines in its external lateral margin. Posterior margin of segment 10 with a convex projection, in ventral view.

**M e a s u r e m e n t s** (in mm). — Total length 26.0; abdomen 18.6; hind femur 5.6; head: length 4.1, width 4.7; caudal appendages 1.8.

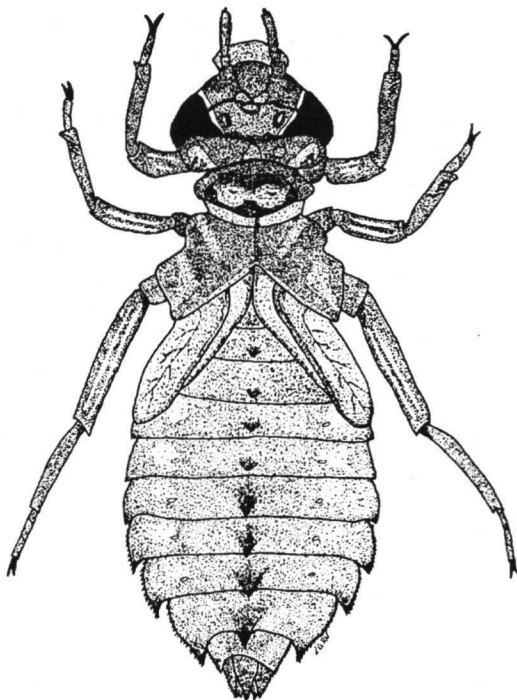


Fig. 22. *Erpetogomphus constrictor*, last instar larva, dorsal view.

*ERPETOGOMPHUS TRISTANI* CALVERT, 1912

Figures 26-27, 32

**Material.** – [2 exuviae (♂, reared)]. – COSTA RICA: Guanacaste, Parque Nacional Guanacaste, Estación Maritza, 25-VII-1991, A. Ramírez leg., in author's collection.

**DESCRIPTION.** – Similar to *E. constrictor*, with the following differences:

**Head.** – Internal branch of the left mandible with eight small teeth, the ventral the largest. The right with four teeth on the internal branch, the dorsal the biggest.

**Abdomen.** – Segment 5 with a small or no lateral spine (Figs 26-27), with a dark dorsal stripe, and a clear one at each side of this; the lateral margins dark. Dorsal hooks as in Figure 32.

*ERPETOGOMPHUS SABALETICUS* WILLIAMSON, 1918

Figures 30-31, 34

BELLE, J., 1992, *Odonatologica* 21(1): 1-24

**Material.** – [2 exuviae (♂, ♀, reared)]. – PANAMA: Canal Zone, Pipeline Rd., Quebrada Juan Grande, ♂, 23-V-1977, ♀, 28-I-1975; M.L. May leg., FSCA.

**DESCRIPTION.** – Similar to the preceding species but with the following differences:

**Thorax.** – Legs with short setae on the tibiae, and covered with scamiform-like setae.

**Abdomen.** – Lateral spines on segments 4-9 (Figs 30-31). The small spines on the lateral margins of the segments are evident on segments 6-9. Epiproct without any row of spines. All the caudal appendages covered with scamiform setae. Dorsal hooks as in Figure 34.

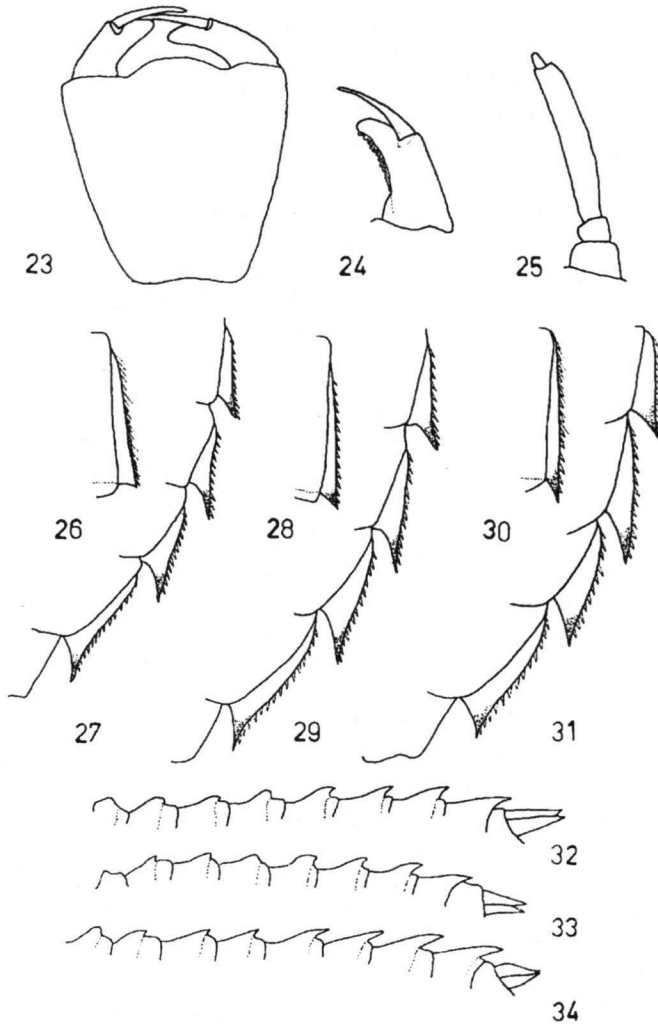
**Measurements** (in mm). – Total length 22.0; abdomen 14.0; hind femur 5.5; prementum, width 2.5, length 3.5; head: width 4.2, length 4.2; caudal appendages 1.8.

**BIOLOGY.** – The larva of this species was described from the specimens in the Florida State Collections of Arthropods (FSCA); to date, no data about its biology are available.

Larvae of *E. tristani* and *E. constrictor* were found in two localities on the Pacific slope of Costa Rica.

Larvae were found living sympatrically with *Phyllogomphoides*, thus the habitat characteristics are the same as those described above. Some other larvae were found in creeks with a slow water flow and a lot of organic matter on the bottom. The water level was never more than 0.4 m deep.

*Erpetogomphus* larvae live among leaves and decaying organic matter, accumulated on the bottom of creeks that run through primary or secondary forest, generally in places where water flow is slow. The flattened and dark body suggests a



Figs 23-31. Details of the morphology of *Erpetogomphus* spp: (23) prementum of *E. constrictor*, dorsal view; – (24) labial palpus of *E. constrictor*, dorsal view; – (25) antenna of *E. constrictor*, dorsal view; – (26) abdominal lateral margin of segment 5, *E. tristani*, ventral view; – (27) abdominal lateral spines of segments 6-10, *E. tristani*, ventral view; – (28) abdominal lateral margin of segment 5, *E. constrictor*, ventral view; – (29) abdominal lateral spines of segments 6-10, *E. constrictor*, ventral view; – (30) abdominal lateral margin of segment 5, *E. sabaleticus*, ventral view; – (31) abdominal lateral spines of segments 6-10, *E. sabaleticus*, ventral view. – Figs 32-34. Abdominal dorsal hooks, lateral view, of: (32) *E. tristani*; – (33) *E. constrictor*; – (34) *E. sabaleticus*.

special adaptation to live and move between leaves.

DISCUSSION. – All *Erpetogomphus* larvae described here are very similar, and separation is difficult. This is obvious if we consider that the adults are separated using only their caudal appendages and thoracic color pattern (GARRISON, 1994). Of the five species reported in Costa Rica, these are the first with their larvae described.

GARRISON (1994) groups all species discussed here into a group named “*tristani*”. In this group, the differences among the adults are slight and the females are difficult to identify.

The following key summarizes the larval distinguishing features:

- |    |  |                    |
|----|--|--------------------|
| 1  | Abdominal lateral spines present on 4-9 .....                                      | <i>sabaleticus</i> |
| 1' | Abdominal lateral spines present on 5 or 6-9 .....                                 | 2                  |
| 2  | Abdominal lateral spines on 5 evident. Legs without setae on the femur .....       | <i>constrictor</i> |
| 2' | Abdominal lateral spines on 5 absent. Legs with many long setae on the femur ..... | <i>tristani</i>    |

#### KEY TO THE GENERA OF THE CENTRAL AMERICAN GOMPHIDAE LARVAE

The few works on Gomphidae larvae deal with the description of one or more species. BELLE gave keys, one for Panamá (BELLE & QUINTERO, 1992) and one for all neotropical genera (1992); both include all Central American genera.

The purpose then of another key is to include some characteristics not used to date. Moreover, the genus *Epigomphus* was misplaced in the other keys. It was included with all the genera that have their wing pads parallel over the abdomen, but in fact these are strongly divergent. This confusion is probably due to the previous too short descriptions (cf. MARTINS, 1968) and to the errors in the drawings of larvae or exuviae (cf. NEEDHAM, 1940).

Because the position of the wing cases is a feature that is prone to mistakes, especially in exuviae, the below key omits this character; the key applicable to intermediate instars. This consideration is important because of the value of the exuviae in diversity studies.

Descriptions found in the literature were used along with the original material.

- |    |   |                     |
|----|---|---------------------|
| 1  | Abdominal dorsal hooks absent on all the segments .....   | 2                   |
| 1' | Abdominal dorsal hooks present on some segments .....   | 3                   |
| 2  | Third antennomere oval, lateral spines present on abdominal segments 6-9, ligula with a row of strong and short teeth .....                             | <i>Epigomphus</i>   |
| 2' | Third antennomere wide, with its inner margins parallel, abdominal lateral spines absent, ligula with tubercles in the middle of the front margin ..... | <i>Perigomphus</i>  |
| 3  | Abdominal segment 10 three times or more as long as segment 9 .....   | 4                   |
| 3' | Abdominal segment 10 variable, but never more than twice the length of segment 9 .....  | 5                   |
| 4  | Labial palpi with strong teeth on its inner margin .....  | <i>Aphylla</i>      |
| 4' | Labial palpi with its inner margin smooth or slightly serrated .....  | <i>Phyllocycla</i>  |
| 5  | Labium twice as wide as long, abdomen clearly wider on segment 5-6, body flattened .....  | <i>Agriogomphus</i> |

- 5' Labium longer than wide, abdomen variable, body little flattened or robust ..... 6
- 6 Tarsal formula 2-2-2, labium spoon-like ..... *Archaeogomphus*
- 6' Tarsal formula 2-2-3, labium flattened ..... 7
- 7 Labial palpi short and wide, distal margin rounded, abdominal segment 10 shorter than 9 ..... 8
- 7' Labial palpi narrow and elongated, ending in a tooth or pointed distally, abdominal segment 10 equal to or longer than 9 ..... 9
- 8 Third antennomere cylindrical, as wide as the second; lateral margins of abdominal segments 6-9 with a row of little spines, ligula with the frontal margin serrated and with a row of setae ..... *Erpetogomphus*
- 8' Third antennomere oval, slightly wider than the second; lateral margins of abdominal segments 6-9 smooth, ligula with a tubercle at each side of the medial line and with many setae ..... *Desmogomphus*
- 9 Mesocoxae closer to each other than to the other coxae in ventral view; labial palpi sharply pointed, without end hook; third antennomere wider than the rest and the fourth vestigial, or the third antennomere as wide as the rest and the fourth elongated ..... *Progomphus*
- 9' Mesocoxae as close to the other coxae as to each other, in ventral view; labial palpi with a well developed end hook; third antennomere as wide as the second, and the fourth vestigial ..... *Phyllogomphoides*

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